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For: A Reinforced Joint for Composite Structures and
Method of Joining Composite Parts

1 1. A method of joining composite parts comprising:
e 2 disposing a plurality of ^{extrinsic} reinforcing elements ^{each extending} through the thickness of two
3 composite adherends to be joined, at least a number of said reinforcing elements
4 extending from the joint surface of each said (adherend);
5 assembling said adherends so that the joint surface of one said adherend
6 faces the joint surface of the other said adherend defining a joint region therebetween,
7 said extending reinforcing elements interstitially disposed in said joint region; and
8 disposing an adherent within said joint region about said interstitially
9 disposed reinforcing elements and said joint surfaces.

1 2. The method of claim 1 in which said adherends are carbon-carbon
2 composite structures.

1 3. The method of claim 1 in which said reinforcing elements are fibers.

1 4. The method of claim 1 in which said adherent is a metallic braze material.

1 5. A joined composite part structure comprising:

2 a pair of composite adherends each including a plurality of reinforcing
3 elements disposed through the thickness thereof, at least a number of said reinforcing
4 elements extending from the joint surface of each said adherend;

5 a joint region between said adherends bounded by the joint surface of each
6 said adherend and including said extending reinforcing elements interstitially disposed
7 therein; and

8 an adherent about said extending interstitially disposed reinforcing
9 elements between said joint surfaces within the joint region.

1. 6. A method of joining composite parts comprising:
c 2 disposing a plurality of ^{extrinsic} reinforcing elements ^{each extending} through the thickness of two
3 composite adherends, said reinforcing elements extending from the joint surface of each
4 said adherend;
5 assembling said adherends so that the joint surface of one said adherend
6 faces the joint surface of the other said adherend;
7 disposing an adherent interlayer between said opposing joint surfaces;
8 urging said extending reinforcing elements of each said adherend through
9 said adherent interlayer and interstitially locking said reinforcing elements therein.

1 7. The method of claim 6 in which said adherent interlayer is a prepreg
2 material, the method further including the step of curing said material. *Splices?*

1. 8. A joined composite part structure comprising:
2 a pair of composite adherends, one said adherend including a plurality of
3 reinforcing elements disposed through the thickness and extending from the joint surface
4 thereof;
5 a joint region between said adherends bounded by the joint surface of each
6 said adherend and including the extending reinforcing elements of said one adherend
7 disposed against the joint surface of the other said adherend; and
8 an adherent disposed in said joint region about said extending reinforcing
9 elements and between said joint surfaces.

1 9. A method of joining composite parts comprising:
c 2 disposing a plurality of ^{extrinsic} reinforcing elements ^{each extending} through the thickness of a
3 first composite adherend to be joined, at least a number of said reinforcing elements
4 extending from the joint surface of said first adherend;
5 assembling said first adherend with a second adherend such that the joint
6 surface of the first said adherend faces the joint surface of the second said adherend at
7 the joint region therebetween, said extending elements of said first adherend disposed
8 against the joint surface of said second adherend; and
9 disposing an adherent within said joint region.

10. A method of joining composite parts comprising:

c 2 disposing a plurality of ^{extrinsic} reinforcing elements ^{each extending} through the thickness of a

3 first composite adherend at the joint surface of said first adherend, at least a number of
4 said reinforcing elements extending from the joint surface of said first adherend;

5 assembling said first adherend with a second adherend such that the joint
6 surface of the first said adherend faces the joint surface of the second said adherend;

7 disposing an adherent interlayer between said opposing joint surfaces; and

8 urging said extending reinforcing elements of said first adherend through
9 said adherent interlayer and against the joint surface of the second said adherend and
10 locking said reinforcing elements therein.

11. The method of claim 10 in which said adherent interlayer is a prepreg

2 material, the method further including the step of curing said prepreg.

12. A method of joining composite parts comprising:

c 2 disposing a plurality of ^{extrinsic} reinforcing elements ^{each extending} through the thickness of two

3 composite adherends at the joint surface of each said adherend to be joined;

4 assembling said adherends so that the joint surfaces of one said adherend
5 faces the joint surface of the opposing said adherend;

6 disposing an adherent within the joint region defined by said facing joint
7 surfaces and urging said adherent to flow at least partially along the length of said
8 reinforcing elements within said adherends.

13. A method of joining a composite part with a non-composite part
comprising:
inserting, through the thickness of said composite part, a plurality of
reinforcing elements extending from the joint surface thereof;
assembling said composite part such that said reinforcing elements are
proximate the joint surface of said non-composite part; and
brazing said joint surfaces and said reinforcing elements to form a joint.

c

14. A method of joining composite parts comprising:
- inserting, through the thickness of each said composite part, a plurality
extrinsic
of reinforcing elements extending from the joint surface thereof;
- assembling said composite parts such that said reinforcing elements are
interstitially disposed at the joint region therebetween;
- selecting a braze material compatible with said composite parts and said
reinforcing elements;
- applying said braze material to said joint region; and
- urging said braze material to flow about said interstitially disposed
reinforcing elements; and
- allowing said braze material to harden.

15. A method of joining composite parts comprising:

inserting, through the thickness of one said composite part, a plurality of

extrinsic
reinforcing elements extending from the joint surface thereof;

assembling one said composite part with a second composite part such that

said reinforcing elements are disposed about the joint surface of said second composite

part;

selecting a braze material compatible with said composite parts, and said

reinforcing elements;

applying said braze material to the joint region between said composite

parts;

urging said braze material to flow about said reinforcing elements; and

allowing said braze material to harden.

1 16. A method of joining composite parts comprising:
2 inserting, through the thickness of each said composite part, a plurality
3 of reinforcing elements extending from the joint surface thereof;
4 selecting an adherent interlayer material for joining said parts;
5 assembling said composite parts such that said joint surfaces face each
6 other with said adherent interlayer therebetween;
7 driving said reinforcing elements into said adherent interlayer and curing
8 said adherent interlayer locking said reinforcing elements therein.

1 17. A method of claim 16 in which said adherent interlayer is a prepreg
2 material and the step of driving said reinforcing elements and curing includes subjecting
3 the assembly to elevated pressure and temperature.

1 18. A method of joining composite parts comprising:

2 inserting, through the thickness of one composite part, a plurality of

c 3 ^{extrinsic}
reinforcing elements extending from the joint surface thereof;

4 selecting an adherent interlayer material for joining said parts;

5 assembling said composite parts such that said joint surfaces face each
6 other with said adherent interlayer therebetween;

7 driving said reinforcing elements into said adherent interlayer and curing
8 said adherent interlayer locking said reinforcing elements therein.

19. A method of joining a composite part with a non-composite part
comprising:
inserting, through the thickness of said composite part, a plurality of
reinforcing elements at least at the joint region thereof;
assembling said composite part such that said reinforcing elements are
disposed proximate the joint surface of said non-composite part; and
brazing said joint surfaces and urging braze material to flow along the
lengths of said reinforcing elements into said composite part.

1 20. A method of joining composite parts comprising:

2 disposing a plurality of ^{extrinsic} reinforcing elements through the thickness of the

3 composite adherends to be joined, at least a number of said reinforcing elements exposed
4 at the joint surface of each said adherent;

5 assembling said adherends so that the joint surface of one said adherend
6 faces the joint surface of the other said adherend defining a joint region therebetween;
7 and

8 disposing an adherent within said joint region and about said exposed
9 reinforcing elements and said joint surface.

1 21. A joined composite part structure comprising:
2 a pair of composite adherends each including a plurality of reinforcing
3 elements disposed through the thickness thereof, at least a number of said reinforcing
4 elements exposed at the joint surface of each said adherend;
5 a joint region between said adherends bounded by the joint surface of each
6 said adherend and including said exposed reinforcing elements; and
7 an adherent about said exposed reinforcing elements between said joint
8 surfaces within the joint region.

22. A method of joining a composite part with a non-composite part,
comprising:

inserting, through the thickness of said composite part, a plurality of
extrinsic
reinforcing elements at least at the joint region thereof, said reinforcing elements exposed
at the joint surface of said composite part;

assembling said composite part such that said exposed reinforcing
elements are disposed proximate the joint surface of said non-composite part; and

disposing an adherent about said exposed reinforcing elements and said
joint surfaces.

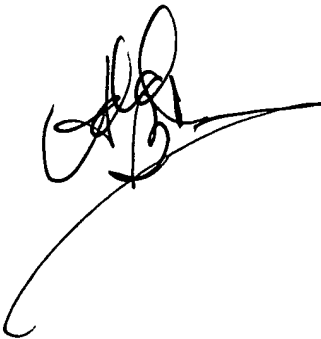
23. A joined structure comprising:

a first adherend having a plurality of reinforcing elements disposed through the thickness thereof exposed at least at the joint surface thereof;

a second adherend the joint surface of which is proximate said exposed reinforcing elements of the first adherent;

a joint region between said adherends bounded by the joint surface of each adherend including said exposed reinforcing elements of said first adherend; and

an adherent disposed in said joint region about said exposed reinforcing elements and between said joint surfaces.

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